PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-336653
(43)Date of publication of application : 26.11.2002

(51)Int.Cl. B01D 53/86
A61L 9/00
A61L 9/22
B01J 19/08
B01J 23/889
C07D319/24
H05H 1/48

(21)Application number : 2001-150586
(22)Date of filing : 21.05.2001

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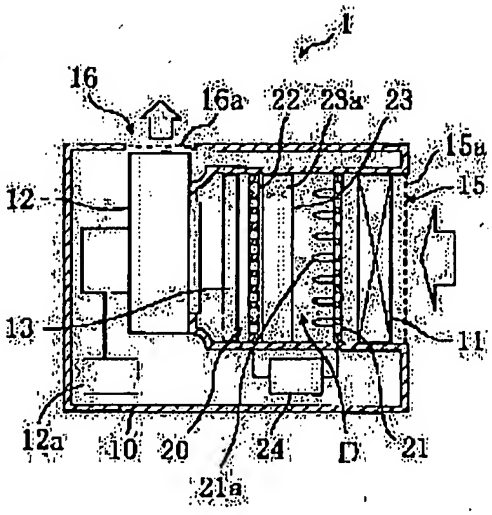
(54) PLASMA CATALYTIC REACTOR, AIR CLEANING APPARATUS, NITROGEN OXIDE CLEANING APPARATUS, WASTE COMBUSTION GAS CLEANING APPARATUS, DIOXINE DECOMPOSING APPARATUS AND FLUOROCARBON GAS DECOMPOSING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To improve reaction acitivity in the presence of a catalyst in a plasma catalytic reactor (20) in which a chemical reaction is accelerated by combining a low-temperature plasma with the catalyst.
SOLUTION: An active species generated from the low temperature plasma is utilized for the chemical reaction on the catalyst by using as a catalytic material a mixture or a multiple oxide of manganese oxide with at least one kind of oxide of iron, cerium, europium, lanthanum and copper.



LEGAL STATUS
[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]

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CLAIMS

[Claim(s)]
[Claim 1] a discharge means (21 22) to generate the low-temperature plasma by discharge in the circulation space of a processed fluid This discharge means (21 22) Discharging space which can be set (D) Inside or discharging space (D) It is the plasma catalytic-reaction machine equipped with the catalyst means (23) arranged at the downstream. The above-mentioned catalyst means (23) as catalyst matter The plasma catalytic-reaction machine characterized by containing the mixture or the multiple oxide of a manganic acid ghost, and iron, a cerium, europium, a lanthanum and at least one sort of oxides of the copper.
[Claim 2] A catalyst means (23) is a plasma catalytic-reaction machine according to claim 1 characterized by the presentation ratio of the manganic acid ghost in the catalyst matter being 20% - 50%.
[Claim 3] The plasma catalytic-reaction machine according to claim 1 or 2 characterized by the catalyst means (23) containing two or more kinds of manganic acid ghosts from which the oxidation number differs as catalyst matter.
[Claim 4] Discharge means (21 22) Plasma catalytic-reaction machine according to claim 1, 2, or 3 characterized by being constituted by streamer discharge, pulse corona discharge, corona discharge, creeping discharge, silent discharge, partial discharge, or glow discharge so that the low-temperature plasma may be generated.
[Claim 5] Discharge means (21 22) Discharging space (D) Inside or discharging space (D) Plasma catalytic-reaction machine according to claim 1, 2, 3, or 4 characterized by arranging an adsorption means (23) to adsorb at the downstream the processed component contained in a processed fluid, with the catalyst means (23).
[Claim 6] A plasma catalytic-reaction machine according to claim 1, 2, 3, 4, or 5 (20), This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, processed air is introduced in the above-mentioned casing (10), and it is a discharge means (21 22). By passing discharging space (D) and a catalyst means (23) The air cleaner characterized by being constituted so that the odor component or injurious ingredient in this processed air may be processed.
[Claim 7] A plasma catalytic-reaction machine according to claim 1, 2, 3, 4, or 5 (20), This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, processed gas is introduced in the above-mentioned casing (10), and it is a discharge means (21 22). By passing discharging space (D) and a catalyst means (23) The nitrogen-oxides purge characterized by being constituted so that the nitrogen oxides in this processed gas may be processed.
[Claim 8] A plasma catalytic-reaction machine according to claim 1, 2, 3, 4, or 5 (20), This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, a combustion gas is introduced in the above-mentioned casing (10), and it is a discharge means (21 22). By passing discharging space (D) and a catalyst means (23) Combustion emission-gas-purification equipment characterized by being constituted so that an unburnt fuel and a hydrocarbon may be processed while processing the nitrogen oxides in this combustion gas.
[Claim 9] A plasma catalytic-reaction machine according to claim 1, 2, 3, 4, or 5 (20), This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, a combustion gas is introduced in the above-mentioned casing (10), and it is a discharge means (21 22). By passing discharging space (D) and a catalyst means The dioxin cracking unit characterized by being constituted so that the dioxin in this combustion gas may be processed.
[Claim 10] A plasma catalytic-reaction machine according to claim 1, 2, 3, 4, or 5 (20), This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, chlorofluocarbon is introduced in the above-mentioned casing (10), and it is a discharge means (21 22). By passing discharging space (D) and a catalyst means (23) The chlorofluocarbon cracking unit characterized by being constituted so that this chlorofluocarbon may be disassembled.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the presentation of the catalyst especially used for a plasma catalytic-reaction machine about the air cleaner using the plasma catalytic-reaction machine which promotes the chemical reaction of a processed fluid combining the low-temperature plasma and catalyst which are generated by discharge, and this plasma catalytic-reaction machine, a nitrogen-oxides purge, combustion emission-gas-purification equipment, a dioxin cracking unit, and a chlorofluocarbon cracking unit.
[0002]
[Description of the Prior Art] Conventionally it faces processing processed fluids, such as air cleaning, and various catalysts are used in order to promote a chemical reaction. As processing using a catalyst, there is the heat catalyst method for activating a catalyst with heating first. Generally he uses noble-metals system catalysts, such as platinum, and is trying to promote oxidation reaction of the processed component in air in this approach. Although the capacity which promotes a chemical reaction rather than the approach of using a following photocatalyst and ozone gas is excellent, since this approach has the need (however, this temperature changes with reactants to oxidize) of generally heating and using a catalyst for an elevated temperature 300 degrees C or more, it has a fault with a comparatively high running cost.
[0003] Next, the photocatalyst method which promotes a chemical reaction using a photocatalyst is also learned. since this approach is the reaction of ordinary temperature, although it is easy to carry it in an air cleaner, since its life of an ultraviolet ray lamp required in order to fully activate a photocatalyst is short -- this ultraviolet ray lamp -- being periodical (every [for example,] several months) -- if it does not exchange, operation cannot be continued over a long period of time, but a great effort and costs are required with that exchange. Furthermore, a photocatalyst method also has the fault which is inferior in the capacity to advance a chemical reaction generally compared with a heat catalyst method.
[0004] Moreover, as an approach of promoting a chemical reaction, the ozone method for using the ozone gas other than the above is also learned. This approach is the reaction of ordinary temperature, and the equipment which decomposes residual ozone gas into oxygen for the harmful nature of ozone gas in addition to the equipment made to generate ozone gas being required is also required. For this reason, in the case of the ozone method, the equipment configuration tends to become complicated and sufficient safety practice is also required. Moreover, there is a fault to which this ozone method is also inferior in the capacity to promote a chemical reaction too compared with a heat catalyst method.
[0005] On the other hand, as other approaches of promoting a chemical reaction, there is the plasma catalyst method for processing combining the plasma and catalyst which were generated by discharge. He activates a catalyst conventionally using the heat at the time of discharge generating the plasma, light, ozone, etc., and is trying to promote a chemical reaction by this approach. And since a high-speed electron and low-speed ion are generated, ion is a low speed and the thermodynamic temperature of reaction space hardly rises to the energy of a high-speed electron being 10eV or more (it being 100,000 degrees C or more by temperature conversion) when using especially the low-temperature plasma, a running cost can be held down compared with a heat catalyst method. Moreover, since this approach is sharply raised in the activity of a catalyst compared with a photocatalyst method or the ozone method, its capacity to promote a chemical reaction is also high.
[0006] As this plasma catalyst method, no-odor-izing or the technique which defangs and purifies air is indicated by JP,8-266854,A in the odor component or the injurious ingredient. He is trying to use the ozone generated in case discharge generates the plasma, heat, and light with a technique given in this official report using the manganese

system catalyst which has the property which decomposes ozone into oxygen and active oxygen, the platinum catalyst activated with heat, the titanium oxide catalyst activated by light.

[0007]

[Problem(s) to be Solved by the Invention] However, by the plasma catalyst method of the above-mentioned official report, in case only the ozone at the time of generating the plasma, heat, and light are used but discharge generates the plasma, the various active species (for example, a hydroxy radical, an excitation oxygen molecule, an excitation nitrogen content child, an excitation water molecule, etc.) generated with ozone, heat, and light are not used. If these active species are used effectively, it will be thought that the reaction of a processed fluid can be promoted, but since these active species are not used at all by the conventional describing [above] plasma catalyst method, the reactivity of a processed fluid cannot fully be raised.

[0008] The place which this invention is originated in view of such a trouble, and is made into the purpose is raising labile more and heightening the throughput of a reactor in the plasma catalytic-reaction machine which promotes a chemical reaction combining the low-temperature plasma and a catalyst.

[0009]

[Means for Solving the Problem] This invention enables it to promote the reaction in the cases, such as gassing, by specifying the component of the catalyst used for a plasma catalytic-reaction machine (20), and using the various active species generated by the plasma effective in processing of a processed fluid.

[0010] Concretely, the 1st solution means which this invention devised is a discharge means (21 22) to generate the low-temperature plasma by discharge in the circulation space of a processed fluid. This discharge means (21 22) Discharging space which can be set (D) Inside or discharging space (D) It is premised on the plasma catalytic-reaction machine (20) equipped with the catalyst means (23) arranged at the downstream. And this plasma catalytic-reaction machine (20) is characterized by the above-mentioned catalyst means (23) containing the mixture or the multiple oxide of a manganic acid ghost (henceforth Mn oxide), and iron, a cerium, europium, a lanthanum and at least one sort of oxide in copper (henceforth a specific oxide) as catalyst matter.

[0011] It sets for this 1st solution means, and is a discharge means (21 22). A processed fluid's passage of the discharging space (D) formed generates the low-temperature plasma. Various active species are generated by this low-temperature plasma, and radicals which are ozone etc., such as others and a hydroxy radical, an excitation oxygen molecule, an excitation nitrogen content child, an excitation water molecule, etc. are contained in these active species. And these active species of various kinds of react efficiently with an injurious ingredient and an odor component with a high active state according to an operation of a catalyst, and carry out decomposition removal of these matter.

[0012] More specifically, Mn oxide contained in the catalyst decomposes into oxygen and active oxygen the ozone generated by discharge. This active oxygen oxidizes and decomposes the injurious ingredient and odor component of a processed fluid into a harmless component or a no odor component. Moreover, various active species including the active oxygen obtained by decomposition of ozone, such as radicals, such as a hydroxy radical contained in low-temperature plasma-like gas, and an excitation oxygen molecule (active oxygen), an excitation nitrogen content child, an excitation water molecule, are adsorbed by the front face of the above-mentioned specific oxide and the interface of Mn oxide and specific oxide which are included in a catalyst means (23) with a radical or an excitation state. For this reason, on the surface of [case / where the injurious ingredient and odor component in a processed fluid use the conventional catalyst] a catalyst, active species with high activity will exist mostly as an active group, and it is decomposed into a high speed.

[0013] Moreover, the 2nd solution means which this invention devised is characterized by a catalyst means (23) making the presentation ratio of the manganic acid ghost in the catalyst matter 20% - 50% in the plasma catalytic-reaction machine (20) concerning the solution means of the above 1st. In this case, since the above-mentioned specific oxide occupies the remainder of Mn oxide in the catalyst matter, that presentation ratio becomes 80% - 50%.

[0014] In this 2nd solution means, among the catalyst matter, since the presentation ratio of Mn oxide is set up to 20% - 50%, Mn oxide and a specific oxide distribute, it is made detailed and the specific surface area of a catalyst increases. Consequently, since the interface of Mn oxide and a specific oxide increases, a catalyst adsorbs more active species and activity improves further.

[0015] Moreover, for the 3rd solution means which this invention devised, it sets in the plasma catalytic-reaction vessel (20) concerning the above 1st or the 2nd solution means, and a catalyst means (23) is MnO2 as catalyst matter. It is characterized by including two or more kinds of manganic acid ghosts from which the oxidation numbers, such as Mn 2O3, differ.

[0016] In this 3rd solution means, since he is trying for a catalyst to contain Mn oxide with which the oxidation number is different, as compared with the case where the number of Mn oxides is one, various active species will be further

adsorbed in the case of the processing reaction of a processed fluid, and a reaction can be presented.
[0017] Moreover, it sets in the plasma catalytic-reaction vessel (20) concerning the above 1st, 2nd, or 3rd solution means, and the 4th solution means which this invention devised is a discharge means (21 22). It is characterized by being constituted by streamer discharge, pulse corona discharge, corona discharge, creeping discharge, silent discharge, partial discharge, or glow discharge so that the low-temperature plasma may be generated. According to a discharge method, various kinds of high voltage power supplies, such as a direct current, an alternating current, and a pulse, can be used for the power source for causing these discharge.
[0018] It sets for this 4th solution means, and is a discharge means (21 22). The low-temperature plasma is generated because set and various kinds of discharge takes place, and it is used for the various active species contained in that gas promoting the chemical reaction of a processed fluid under existence of the above-mentioned catalyst.
[0019] Moreover, the 5th solution means which this invention devised is set in the plasma catalytic-reaction vessel (20) concerning the above 1st, 2nd, 3rd, or 4th solution means. Discharge means (21 22) Discharging space (D) Inside or discharging space (D) It is characterized by arranging an adsorption means (23) to adsorb the processed component contained in a processed fluid at the downstream, with the catalyst means (23).
[0020] In this 5th solution means, since an adsorption means (23) is adsorbed in the processed component which a processed fluid contains, with the processed component which is contained in a processed fluid and is floating under existence of a catalyst, the active species contained in low-temperature plasma-like gas acts also on the processed component of which the adsorption means (23) is adsorbed, and carries out decomposition removal of these components. That is, discharging space (D) The various active species generated act not only on the processed component which floats in a processed fluid but on the processed component of which the adsorption means (23) was adsorbed.
[0021] Moreover, the 6th solution means which this invention devised is an air cleaner (a deordorization machine and air cleaner) (1) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. It is related. This air cleaner (1) This plasma catalytic reaction machine (20) be equip with casing (10) contain inside, processed air be introduce in this casing (10), and it be a discharge means (21 22). Discharge space (D) And by pass a catalyst means (23), it be characterize by be constitute so that the odor component or injurious ingredient in this processed air may be process.
[0022] With this 6th solution means, processed air is purified in the odor component or injurious ingredient in processed air by processing oxidative degradation etc. with the low-temperature plasma and a catalyst means (23).
[0023] Moreover, the 7th solution means which this invention devised is related with the nitrogen-oxides purge (2) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. This nitrogen-oxides purge (2) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, processed gas is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And by passing a catalyst means (23), it is characterized by being constituted so that the nitrogen oxides in this processed gas may be processed.
[0024] With this 7th solution means, processed gas is purified in the nitrogen oxides in non-raw gas by processing reduction decomposition etc. with the low-temperature plasma and a catalyst means (23).
[0025] Moreover, the 8th solution means which this invention devised is related with the combustion emission-gas-purification equipment (3) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. This combustion emission-gas-purification equipment (3) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside. A combustion gas is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And while processing the nitrogen oxides in this combustion gas by passing a catalyst means (23) It is characterized by being constituted so that an unburnt fuel and a hydrocarbon may be processed.
[0026] A combustion gas is purified by this 8th solution means by processing an unburnt fuel and a hydrocarbon by oxidative degradation etc., while using together the low-temperature plasma and a catalyst means (23) and processing the nitrogen oxides in a combustion gas by reduction decomposition etc.
[0027] Moreover, the 9th solution means which this invention devised is a dioxin cracking unit (4) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. It is related. This dioxin cracking unit (4) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, a combustion gas is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And by passing a catalyst means (23), it is characterized by being constituted so that the dioxin in this combustion gas may be processed.
[0028] With this 9th solution means, a combustion gas is purified in the dioxin in a combustion gas by processing

oxidative degradation etc. with the low-temperature plasma and a catalyst means (23).
[0029] Moreover, the 10th solution means which this invention devised is a chlorofluocarbon cracking unit (5) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. It is related. This chlorofluocarbon cracking unit (5) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, chlorofluocarbon is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And by passing a catalyst means (23), it is characterized by being constituted so that this chlorofluocarbon may be disassembled.
[0030] With this 10th solution means, decomposition processing of the chlorofluocarbon can be certainly carried out by using together the low-temperature plasma and a catalyst means (23).
[0031]
[Effect of the Invention] According to the solution means of the above 1st, by having specified the catalyst matter, in case the various active species generated by the low-temperature plasma process processed fluids, such as air cleaning, it is used effectively, and the chemical reaction in that case can be promoted by leaps and bounds. Therefore, the throughput of a plasma catalytic-reaction machine (20) can be heightened now. Moreover, since a throughput is heightened in this way, it also becomes possible to miniaturize a reactor (20).
[0032] According to the solution means of the above 2nd, among the catalyst matter, since he is trying for a catalyst to adsorb more active species by setting up the presentation ratio of Mn oxide to 20% - 50%, and enlarging specific surface area of a catalyst, the chemical reaction at the time of processing a processed fluid can be promoted further. Therefore, it becomes possible to heighten the throughput of a plasma catalytic-reaction machine (20) more.
[0033] Moreover, since it enables it to use many kinds of active species by the time of processing of a processed fluid by including Mn oxide with which the oxidation number is different in a catalyst according to the solution means of the above 3rd, it becomes possible to promote a reaction further. Therefore, the throughput of a plasma catalytic-reaction machine (20) can be heightened further.
[0034] Moreover, a discharge means to cause streamer discharge, pulse corona discharge, corona discharge, creeping discharge, silent discharge, partial discharge, or glow discharge according to the solution means of the above 4th (21 22) It uses and the low-temperature plasma is generated, and since he is trying to promote the chemical reaction of a processed fluid using the various active species contained in the gas, the plasma catalytic-reaction machine (20) of various discharge methods is utilizable.
[0035] Moreover, it is discharging space (D) in a catalyst means (23) about an adsorption means (23) to adsorb the processed component of a processed fluid according to the solution means of the above 5th. Inside or discharging space (D) It arranges to the downstream. Since he is trying to adsorb the processed component which a processed fluid contains with an adsorption means (23), the processed component of which not only a processed component but an adsorption means (23) by which the active species contained in low-temperature plasma-like gas floated in a processed fluid was adsorbed also carries out decomposition processing certainly. Therefore, the processing engine performance of a plasma catalytic-reaction machine (23) can be raised more. Moreover, since the processing engine performance can be prevented from falling if a processed component is caught with an adsorption means (23) in this way and it enables it to decompose even if it shortens a charging time value, it is also possible to raise energy-saving nature.
[0036] moreover, above-mentioned the 6- by having specified the configuration of a catalyst as the above-mentioned Mn oxide and the specific oxide in various kinds of equipments which use together the low-temperature plasma and a catalyst means (23), and process a processed fluid according to the 10th solution means since the active species generated by discharge can be used effectively -- respectively -- air cleaner (1) Nitrogen-oxides purge (2) Combustion emission-gas-purification equipment (3) Dioxin cracking unit (4) And chlorofluocarbon cracking unit (5) etc. -- a throughput can be heightened.
[0037]
[The gestalt 1 of implementation of invention] Hereafter, the operation gestalt of this invention is explained to a detail based on a drawing.
[0038] This operation gestalt is an air cleaner (1) which processes the odor component or injurious ingredient in processed air by oxidative degradation, and purifies air. It is related. Drawing 1 is this air cleaner (1). The outline configuration is shown.
[0039] It is this air cleaner (1) so that it may illustrate. It is the configuration that each functional part was contained in casing (10), and the dust collection filter (11), the centrifugal fan (12), and the plasma catalytic-reaction machine (20) are contained in casing (10) as a functional part. In addition, it is the ozonolysis catalyst for decomposing the ozone generated by discharge with a plasma reactor (20) which the sign (13) shows to drawing 1 .
[0040] In one side face (side face on the right-hand side of drawing) of casing (10), the air suction port (15) for inhaling

air is formed in casing (10), and the air port (16) for blowing off purification air is formed in the top face. In an air suction port (15), it is an intake grill (15a). It is prepared and is a blow-off grill (16a) in an air port (16). It is prepared. Moreover, in an air suction port (15), it is an intake grill (15a). The above-mentioned dust collection filter (11) is arranged inside, and it is made to carry out uptake of the dust contained in intake air.

[0041] The air port (16) is formed in the edge (edge on the left-hand side of drawing 1) of the opposite side with the air suction port (15) on the top face of casing (10). And corresponding to this air port (16), the above-mentioned centrifugal fan (12) is prepared in casing (10). In this centrifugal fan (12), it is a power source for fans (12a). It connects. In the above configuration, as for the interior of casing (10), between an air suction port (15) and air ports (16) is the circulation space of processed air. And if a centrifugal fan (12) is started, processed air is the intake grill (15a) of an air suction port (15). And it absorbs in casing (10) through a dust collection filter (11). after processing with the reactor (20) which explains processed air in full detail below -- blow-off grill (16a) of an air port (16) from -- it blows off besides casing (10).

[0042] The sectional view in which drawing 2 shows the outline configuration of a plasma reactor (20), and drawing 3 are perspective views. This plasma reactor (20) is the discharge electrode (21) as a discharge means for generating the low-temperature plasma and counterelectrodes (22), and these electrodes (21 22). It has the processing member (23) arranged by approaching a counterelectrode (22) in between. That is, a processing member (23) is discharging space (D). It is arranged in inside.

[0043] stoma (23b) of a large number which penetrate this processing member (23) along the flow direction of air Base material (23a) of the honeycomb configuration which it has from -- it is constituted and the catalyst matter is supported on that front face. Concretely, this processing member (23) contains the mixture or the multiple oxide of a manganic acid ghost, and iron, a cerium, europium, a lanthanum and at least one sort of oxide in copper (henceforth a specific oxide) as catalyst matter. And the presentation ratio of Mn oxide in the catalyst matter is 20% - 50%, and the processing member (23) is set up so that the presentation ratio of a specific oxide may become 80% - the 50 remaining%. Moreover, two or more kinds of manganic acid ghosts from which the oxidation number is different, such as MnO2 and Mn 2O3, are contained in the catalyst matter.

[0044] The catalyst of this operation gestalt consists of manganese, iron, and a cerium, is the following, and was specifically made and prepared. That is, the water solution of manganese nitrate 6 hydrate was first prepared as a manganese compound, cerium-nitrate 6 hydrate as a cerium compound was added to this, iron nitrate 9 hydrate was further added as an iron compound, and it considered as A liquid. On the other hand, B liquid with which water comes to melt an alkali compound was produced as a precipitate reagent. And the coprecipitate was made to generate by slushing A liquid, agitating B liquid. Then, aging of 1 hour is performed, the above-mentioned coprecipitate was washed and dried, by calcinating for 5 hours at the temperature of 500 degrees C in air, the catalyst which consists of manganese, iron, and a cerium was acquired, and this was used for the honeycomb-like processing member (23).

[0045] The above-mentioned processing member (23) is a base material (23a). On the front face, the adsorbent is also supported with the above-mentioned catalyst matter. An adsorbent adsorbs processed components contained in processed air, such as odorant and harmful matter, and activated carbon, a zeolite, etc. are used. In addition, it is good for an adsorbent to use porous ceramics, activated carbon fiber, mordenite, a ferrierite, Silicalite, etc., and to use at least one of sorts of these.

[0046] As mentioned above, since the processing member (23) has the catalyst matter and an adsorbent, it is also an adsorption means to adsorb the processed component contained to processed air, in this operation gestalt while this processing member (23) is a catalyst means to promote the processing at the time of purifying processed air.

[0047] the above-mentioned discharge electrode (21) -- electrode plate (21b) This electrode plate (21b) Two or more needle electrodes (21a) fixed so that it might intersect perpendicularly mostly from -- it is constituted. Electrode plate (21b) Opening of a large number which consist of mesh material, a punching metal, etc. and air passes in the direction of a field right angle (21c) It has. Moreover, opening of a large number which air passes in the direction of a field right angle like mesh material or a punching metal to a counterelectrode (22) (22a) The electrode plate which it has is used. And a discharge electrode (21) is an electrode plate (21b). It is almost parallel to a counterelectrode (22), and is a needle electrode (21a). It is arranged so that it may become a right angle to a counterelectrode (22) mostly.

[0048] two electrodes (21 22) **** -- the high voltage power supply (power-source means) (24) of a direct current is connected, and he is trying for streamer discharge to arise between a discharge electrode (21) and a counterelectrode (22) this streamer discharge -- discharging space (D) **** -- low-temperature plasma-like gas occurs. Radicals, such as a high-speed electron, ion, ozone, and a hydroxy radical, and other excited molecules (an excitation oxygen molecule, an excitation nitrogen content child, excitation water molecule, etc.) are contained in this gas as active species.

[0049] Streamer discharge is formed as a plasma column accompanied by luminescence, when a minute arc continues

from the tip of a discharge electrode (21) even to a counterelectrode (22), and a minute arc stands in a row and progresses between a discharge electrode (21) and a counterelectrode (21) in the place where spacing of the equipotential surface is narrow. At this operation gestalt, it is a needle electrode (21a). The tip should be deleted by the 60 degrees (or 30 degrees - 90 degrees) cutting angle (theta), and the tip shall have few [a radius R] radii of circle as a spherical-surface configuration which is 0.5mm (refer to drawing 13). And since whenever [point-angle / of a discharge electrode (21)] (theta) is specified as the above-mentioned include angle, a minute arc becomes easy to progress with breadth broadly, and streamer discharge is wide range and arises. That is, the streamer discharge in this case is generated in the field which spread in the shape of the flare toward the counterelectrode (22) from the discharge electrode (21). for this reason, the streamer discharge using the direct-current high voltage -- setting -- each needle electrode (21a) about -- since a discharge field becomes large -- needle electrode (21a) Even if it lessens a number comparatively, a plasma generating field can be extended.

[0050] - Operation actuation -, next this air cleaner (1) Operation actuation is explained.

[0051] This air cleaner (1) If operation is started and a centrifugal fan (12) starts, first, processed air will be inhaled from an air suction port (15), and uptake of the dust contained in this air will be carried out with a dust collection filter (11). Equipment (1) The air from which streamer discharge has arisen between the discharge electrodes (21) and counterelectrodes (22) of a plasma catalytic-reaction machine (20) at the time of operation, and dust was removed with the dust collection filter (11) is two electrodes (21 22). Discharging space of a between (D) It passes.

[0052] The above-mentioned processed air is discharging space (D). If it passes, the harmful matter and odorant which were activated by the operation of streamer discharge and were similarly activated on the catalyst of a processing member (23), and active species will react efficiently, and will carry out decomposition removal of these matter. For this reason, the harmful matter and odorant in air are quickly disassembled by the synergistic effect of the plasma and a catalyst.

[0053] Specifically, Mn oxide contained in the catalyst decomposes into oxygen and active oxygen the ozone generated by discharge. This active oxygen oxidizes and decomposes the injurious ingredient and odor component of a processed fluid into a harmless component or a no odor component. Moreover, various active species including the active oxygen obtained by decomposition of ozone, such as radicals, such as a hydroxy radical, and an excitation oxygen molecule (active oxygen), an excitation nitrogen content child, an excitation water molecule, are adsorbed by the front face of the above-mentioned specific oxide and the interface of Mn oxide and a specific oxide which are included in a catalyst means (23) with active species. For this reason, on the surface of [case / where the injurious ingredient and odor component in processed air use the conventional catalyst] a catalyst, active species with high activity will exist mostly as an active group, and it will be decomposed into a high speed.

[0054] Furthermore, since the adsorbent is also contained in the processing member (23), the harmful matter and odorant in processed air act for these components certainly [the active species which an adsorbent is adsorbed and is generated by the low-temperature plasma], and decomposition processing is promoted. That is, processing stabilized more is performed by having made it include a catalyst and an adsorbent in one processing member (23).

[0055] - The iron which is a manganic acid ghost and the above-mentioned specific oxide according to the effectiveness-book operation gestalt 1 of the operation gestalt 1, By having used the catalyst containing mixture or a multiple oxide with a cerium, europium, a lanthanum, and at least one sort of oxides of the copper It is used effective in the processing at the time of the various active species generated by the low-temperature plasma performing air cleaning, and the chemical reaction at the time of processing processed air can be promoted by leaps and bounds. Moreover, processing can be promoted also from many [broadly and] active species being made to be generated, as it is wide range and streamer discharge is caused. Therefore, since the throughput of a plasma catalytic-reaction machine (20) can be heightened, it is an air cleaner (1). The capacity to carry out can also be heightened.

[0056] Moreover, among the catalyst matter, since Mn oxide and other specific oxides distribute, it is made detailed and the specific surface area of a catalyst increases by setting up the presentation ratio of Mn oxide to 20% - 50%, the interface of Mn oxide and a specific oxide increases and a catalyst adsorbs more active species. Furthermore, since it is effective in Mn oxide and a specific oxide making it detailed, and the specific surface area of a catalyst increasing also by preparing the catalyst containing Mn oxide and a specific oxide with a coprecipitation method, the interface of Mn oxide and a specific oxide will increase, many active species can be adsorbed, and activity improves further.

[0057] Moreover, it is MnO2 by preparing a catalyst with a coprecipitation method. Since the manganic acid ghost from which the oxidation numbers, such as Mn 2O3, differ in addition will also be contained in a catalyst and can use many kinds of active species by the time of processing, activity improves further. Furthermore, since many multiple oxides to the interface of Mn oxide and a specific oxide of Mn oxide and a specific oxide are especially generated by preparing a catalyst with a coprecipitation method, Mn oxide (MnO2, Mn 2O3) and a specific oxide (Fe2 O3 and

CeO2) can also obtain the multiple oxide (MnCeFe 2O4) with which oxidation numbers differ, and can use more radicals.
[0058] Moreover, CeO2 which is the oxide when a cerium is used as matter other than manganese Since it has oxygen occlusion capacity, the amount of the oxygen with which a reaction can be presented on a catalyst increases. For this reason, the activity of reaction time is raised compared with the case where Ce is not used. Furthermore, since a nearby kind many of active species can be used by the case where europium, a lanthanum, or copper is added, activity becomes still higher, and a reaction can be promoted.
[0059]
[The gestalt 2 of implementation of invention] The above-mentioned operation gestalt 1 to the low-temperature plasma generated by streamer discharge Air cleaner which processes the odor component or injurious ingredient in processed air by oxidative degradation, and purifies air using the plasma catalytic-reaction machine (20) which combined the catalyst containing a manganic acid ghost and specific oxides, such as iron and a cerium, (1) Although constituted The plasma catalytic-reaction machine (20) of this invention is a nitrogen-oxides purge (2) which processes the nitrogen oxides in processed gas by reduction decomposition etc. It is also applicable. In this case, the thing suitable for processing of nitrogen oxides is selected by the catalyst from the catalyst matter explained with the operation gestalt 1.
[0060] In drawing 4 , it is a nitrogen-oxides purge (2). Cross-section structure is shown typically. This nitrogen-oxides purge (2) It has a gas inlet (it is equivalent to the air suction port of the operation gestalt 1) (15), and gas exhaust (similarly it is equivalent to an air port) (16) on the side attachment wall of the pair of casing (10), and the dust collection filter (11) is arranged along the gas inlet (15) in casing (10). Moreover, the plasma catalytic-reaction machine (20) has the structure where the processing member (23) of the shape of a honeycomb which supported the catalyst containing a manganic acid ghost and a specific oxide between the discharge electrode (21) and the counterelectrode (22) like **** has been arranged.
[0061] This equipment (2) The fan is not prepared in casing (10). and this equipment (2) **** -- doubling the sense of the above-mentioned gas inlet (15) and gas exhaust (16) with the passage of the processed gas which contains nitrogen oxides as a processed component, and arranging casing (10) -- processed gas -- discharging space (D) He is trying to pass.
[0062] This nitrogen-oxides purge (2) Space [discharging] the processed gas which contains nitrogen oxides then is introduced in casing (10) from a gas inlet (15), and according to streamer discharge (D) It passes. Therefore, processed gas is activated by the plasma, and when the active species contained in the gas passes a processing member (23), nitrogen oxides are returned to nitrogen gas on a catalyst.
[0063] Also in this operation gestalt 2, by having specified the catalyst matter, it is used effective in the processing at the time of the various active species generated by the low-temperature plasma performing air cleaning, and the chemical reaction at the time of processing processed gas can be promoted by leaps and bounds. Therefore, since the throughput of a plasma catalytic-reaction machine (20) can be heightened, it is a nitrogen-oxides purge (2). The capacity to carry out can also be heightened.
[0064] - The modification-(modification 1) above-mentioned implementation gestalt 2 of the operation gestalt 2 is a nitrogen-oxides purge (2) about the plasma catalytic-reaction machine (20) using the discharge plasma by streamer discharge. Although it is the applied example, this plasma catalytic-reaction machine (20) is combustion emission-gas-purification equipment (3). It is also applicable. Combustion emission-gas-purification equipment (3) While processing the nitrogen oxides in a combustion gas by reduction decomposition etc., an unburnt fuel and a hydrocarbon are processed by oxidative degradation. In this case, the thing suitable for oxidation of reduction of nitrogen oxides, an unburnt fuel, and a hydrocarbon is selected by the catalyst from the catalyst matter explained with the operation gestalt 1.
[0065] This combustion emission-gas-purification equipment (3) A configuration is the above-mentioned nitrogen-oxides purge (2). It is shown in drawing 4 , and a configuration is the same and only the candidates for application differ. For this reason, combustion emission-gas-purification equipment (3) Although the concrete explanation about a configuration is omitted, since he is trying to promote a chemical reaction by specifying the catalyst matter, using effectively the active species contained in low-temperature plasma-like gas, also in this equipment (3), the processing engine performance of processed gas is raised sharply.
[0066] (Modification 2) The plasma catalytic-reaction machine (20) of this invention is an air cleaner (1). Nitrogen-oxides purge (2) And combustion emission-gas-purification equipment (3) Otherwise, it is a dioxin cracking unit (4). It is also applicable. Dioxin cracking unit (4) The dioxin in a combustion gas is processed by oxidative degradation. In this case, the thing suitable for the oxidative degradation of dioxin is adopted as a catalyst out of the catalyst matter explained with the operation gestalt 1.

[0067] this dioxin cracking unit (4) Nitrogen-oxides purge (2) etc. -- it can consider as the same equipment configuration. This equipment (4) The processing engine performance of processed gas is sharply raised by also setting and promoting a chemical reaction by using the catalyst by which it is characterized [of this invention], using effectively the active species contained in low-temperature plasma-like gas.
[0068] (Modification 3) The plasma catalytic-reaction machine (20) of this invention is an air cleaner (1) further. Nitrogen-oxides purge (2) Combustion emission-gas-purification equipment (3) And dioxin cracking unit (4) Otherwise, it is a chlorofluocarbon cracking unit (5). It is also applicable. Chlorofluocarbon cracking unit (5) It is a discharge means (21 22) about chlorofluocarbon. Discharging space (D) And this chlorofluocarbon is disassembled by passing a processing member (23). In this case, the thing suitable for disassembly of chlorofluocarbon is adopted as a catalyst out of the catalyst matter explained with the operation gestalt 1.
[0069] this chlorofluocarbon cracking unit (5) Nitrogen-oxides purge (2) etc. -- it can consider as the same equipment configuration. And this equipment (5) Since a chemical reaction can be promoted by also setting and using the catalyst by which it is characterized [of this invention], using effectively the active species generated by the low-temperature plasma, the processing engine performance of processed gas is raised sharply.
[0070]
[The gestalt 3 of implementation of invention] The operation gestalt 3 of this invention changes a discharge method with each above-mentioned operation gestalt, and it is made to generate the low-temperature plasma by pulse corona discharge in a plasma catalytic-reaction machine (20). That is, it sets in the above-mentioned operation gestalt 1 and the operation gestalt 2, and is an electrode (21 22). He is trying to cause pulse corona discharge in the field of the shape of a column narrower than it by this operation gestalt 3 to trying to cause streamer discharge in a conic large field in between. In addition, although pulse corona discharge is also a kind of streamer discharge, in order to distinguish from the operation gestalten 1 and 2, it is called pulse corona discharge especially here. With this operation gestalt 3, it is based on drawing 5 , and is a discharge means (21 22). Only a configuration is explained.
[0071] With this operation gestalt 3, the cylindrical electrode is used as a discharge electrode (21). As an imaginary line shows this cylindrical electrode, two or more are being fixed to electrode plates, such as mesh material and a punching metal, like the operation gestalt 1. Moreover, the flat electrode which had openings, such as mesh material and a punching metal, like the above-mentioned operation gestalt 1 is used for the counterelectrode (22). and two electrodes (21 22) **** -- the pulse power source (24) which is not illustrated is connected and he is trying for pulse corona discharge to arise between a discharge electrode (21) and a counterelectrode (22)
[0072] in addition, discharging space (D) by the pulse corona discharge of this operation gestalt Discharging space (D) of the streamer discharge explained with each above-mentioned operation gestalt since it is the field of the shape of a narrow column -- the line as a discharge electrode (21) -- an electrode -- needle electrode (21a) of the operation gestalt 1 It is good to arrange densely.
[0073] thus, two electrodes (21 22) even if it constitutes so that pulse corona discharge may be caused in between -- discharging space (D) **** -- active species is generated by the low-temperature plasma. Radicals, such as a high-speed electron which promotes the reaction in a plasma catalytic-reaction machine, ion, ozone, and a hydroxy radical, and other excited molecules (an excitation oxygen molecule, an excitation nitrogen content child, excitation water molecule, etc.) are contained in this active species.
[0074] Processing members (23) are two electrodes (21 22) like the operation gestalt 1. Discharging space formed in between (D) It is arranged near the counterelectrode (22) in inside, and the same thing as the operation gestalt 1 is used for a catalyst. For this reason, since it is used effective in the processing at the time of the various active species generated by the low-temperature plasma performing air cleaning, the chemical reaction at the time of processing processed air etc. can be promoted by leaps and bounds. since [therefore,] the throughput of a plasma catalytic-reaction machine (20) can be heightened -- air cleaner (1) etc. -- capacity can also be heightened.
[0075] In addition, as a discharge method which generates the low-temperature plasma, discharge methods other than streamer discharge and pulse corona discharge explained above, such as corona discharge, creeping discharge, silent discharge, partial discharge, or glow discharge, may be adopted. Then, it explains briefly [below] about these discharge methods.
[0076] - Modification of the operation gestalt 3 - (modification 1) The example of corona discharge is first explained with reference to drawing 6 as a discharge method of a plasma catalytic-reaction machine (20). Moreover, air cleaner when adopting this discharge method (1) It can constitute, as shown in drawing 7 .
[0077] in this example, a tabular electrode plate uses for a discharge electrode (21) and a counterelectrode (22), respectively -- having -- **** -- two electrodes (21 22) **** -- although not illustrated, much openings are prepared so that air may pass in the direction of a field right angle. for example, each electrode (21 22) **** -- mesh material, a

punching metal, etc. can be used. moreover, two electrodes (21 22) **** -- the high voltage power supply (not shown) of a direct current or an alternating current is connected, and it is constituted so that corona discharge may arise between a discharge electrode (21) and a counterelectrode (22).
[0078] In addition, to a discharge electrode (21), it is desirable to form a minute projection in the field by the side of a counterelectrode, and discharge can be stabilized and caused by doing so to it.
[0079] Furthermore, two electrodes (21 22) In between, the processing member (23) including the same catalyst (the above-mentioned Mn oxide and specific oxide) as each above-mentioned operation gestalt is arranged. Processing members (23) are two electrodes (21 22). Discharging space formed in between (D) In inside, it is arranged near the counterelectrode (22).
[0080] Moreover, as shown in drawing 7 , it is an air cleaner (1). In casing (10), a plasma catalytic-reaction machine (20), a dust collection filter (11), and a centrifugal fan (12) are prepared, and it is constituted so that the air inhaled from the air suction port (15) may be processed and it may blow off from an air port (16).
[0081] thus -- the case where corona discharge is adopted -- discharging space (D) **** -- active species occurs by the low-temperature plasma. And radicals, such as an electron, ion, ozone, and a hydroxy radical, and other excited molecules (an excitation oxygen molecule, an excitation nitrogen content child, excitation water molecule, etc.) are contained in active species. Therefore, the chemical reaction at the time of processing processed air, since the various active species generated by the low-temperature plasma by using the catalyst by which it is characterized [of this invention] can be used effective in the processing in the case of air cleaning can be promoted by leaps and bounds, and they are the throughput of a plasma catalytic-reaction machine (20), as a result an air cleaner (1). A throughput can be heightened.
[0082] in addition -- this example -- air cleaner (1) ******** -- the plasma catalytic-reaction machine (20) made to generate the low-temperature plasma by corona discharge although explained -- **** -- the same -- nitrogen-oxides purge (2) Combustion emission-gas-purification equipment (3) Dioxin cracking unit (4) And chlorofluocarbon cracking unit (5) etc. -- applying is possible.
[0083] Moreover, it may replace with the high voltage power supply of a direct current or an alternating current, and a pulse height electrical-potential-difference power source may be used for a power source. If a pulse height electrical-potential-difference power source is used, since discharge can arise with high energy more, it is the discharging space (D). The activity of the low-temperature plasma generated can be raised more. And since these active species react with the injurious ingredient of processed air etc. under existence of a catalyst and decompose these components, the higher processing engine performance can be obtained.
[0084] Thus, if a processed fluid is processed for the catalyst by which it is characterized [of this invention] combining this low-temperature plasma while generating the low-temperature plasma using a pulse height electrical potential difference, the chemical reaction at the time of processing processed air can be promoted by leaps and bounds. since [and] the throughput of a plasma catalytic-reaction machine (20) can be sharply heightened by using active species effectively -- air cleaner (1) etc. -- capacity can also be heightened sharply.
[0085] (Modification 2) Next, creeping discharge may be adopted as a discharge method which generates the low-temperature plasma with a plasma catalytic-reaction vessel (20). The example of this discharge method is explained based on drawing 8 .
[0086] this modification 2 -- discharge means (21 22) ****** -- dielectric substrates (25a), such as a ceramic, from -- the becoming electrode plate (25) is used. In this electrode plate (25), it is the above-mentioned dielectric substrate (25a). The discharge electrode (21) and the counterelectrode (22) are prepared in the interior and a front face. And the power source which is not illustrated to two electrodes (21 22) Creeping discharge is generated by impressing RF alternating voltage (or RF pulse voltage) in between, and itis [plasma-] made toize processed air and processed gas.
[0087] In this case, the whole perimeter surface of an electrode plate (25) is discharging space (D). It becomes and is this discharging space (D). The low-temperature plasma is generated and active species is emitted. And the processing member (23) including the catalyst explained to the downstream of this electrode plate (25) with each above-mentioned operation gestalt is arranged, and the active species generated by the plasma is made to be supplied to a processing member (23).
[0088] Also in this modification 2, since he is trying to use the same catalyst matter as each above-mentioned operation gestalt for a processing member (23), processed air (or processed gas) can be processed using effectively the active species generated by the low-temperature plasma, and the chemical reaction at the time of being that processing can be promoted by leaps and bounds. therefore, air cleaner (1) which applies this reactor (20) since the throughput of a plasma catalytic-reaction machine (20) can be heightened etc. -- capacity can also be heightened sharply.
[0089] (Modification 3) In a plasma catalytic-reaction machine (20), silent discharge is used for the modification 3 of

the operation gestalt 3 as a discharge method. In this modification 3, it is based on drawing 9 , and is a discharge means (21 22). Only a configuration is explained.
[0090] The discharge electrode (21) and the counterelectrode (22) are constituted from this plasma catalytic-reaction machine (20) by the flat electrode, respectively. The laminating of the electric insulating plate (26) is carried out to a discharge electrode (21) and a counterelectrode (22), respectively, and they are two electrodes (21 22). Electric insulating plate (26 26) It carries out inside and opposite arrangement is carried out. and two electrodes (21 22) **** -- the high voltage power supply (not shown) which impresses RF alternating voltage (or RF pulse voltage) is connected.
[0091] Moreover, the discharge electrode (21) and the counterelectrode (22) are arranged almost in parallel with the flow direction of a processed fluid so that a processed fluid may flow the meantime. And discharging space formed between a discharge electrode (21) and a counterelectrode (22) (D) The processing member (23) containing the catalyst matter explained to the downstream with each above-mentioned operation gestalt is arranged.
[0092] It sets in this configuration and they are two electrodes (21 22). When RF alternating voltage or a RF pulse voltage is impressed in between, an electric insulating plate (26) is minded and it is the discharging space (D) of silent discharge. It is formed. And various active species are generated by this silent discharge, and active species flows and goes to a processing member (23). Therefore, active species reacts efficiently with the injurious ingredient of processed air etc. under existence of a catalyst, and decomposes these components.
[0093] Also in this example, since he is trying to use the same catalyst matter as ****, processed air (or processed gas) can be processed using effectively the active species generated by the low-temperature plasma, and the chemical reaction in that case can be promoted by leaps and bounds. therefore, air cleaner (1) which applies this reactor (20) since the throughput of a plasma catalytic-reaction machine (20) can be heightened etc. -- capacity can also be heightened sharply.
[0094] (Modification 4) In a plasma catalytic-reaction machine (20), partial discharge is used for the modification 4 of the operation gestalt 3 as a discharge method. In this example, it is based on drawing 10 , and is a discharge means (21 22). Only a configuration is explained.
[0095] this plasma catalytic-reaction machine (20) -- a discharge electrode (21) -- a line -- it is constituted by the electrode and the counterelectrode (22) is constituted by the tubed (cylindrical) electrode arranged considering a discharge electrode (21) as a core. two electrodes (21 22) **** -- the high voltage power supply (not shown) which impresses RF alternating voltage (or RF pulse voltage) is connected. By this configuration, it is discharging space (D) to the interior of a cylinder-like counterelectrode (22). It will be formed. in addition -- a discharge electrode (21) -- the line of drawing -- an electrode [being cylindrical (or cylindrical)] thicker than an electrode may be used.
[0096] The interior of the above-mentioned counterelectrode (22) is filled up with the catalyst particle (23) containing the above-mentioned catalyst matter (specific oxides, such as a manganic acid ghost and iron, and a cerium) by which it is characterized [of this invention]. That is, a catalyst particle (23) is discharging space (D). It is arranged in inside and the plasma catalytic-reaction machine (20) has taken the so-called gestalt of a pack DOBEDDO reactor. A catalyst particle (23) supports the above-mentioned catalyst matter on the front face of ferroelectric particles, such as barium titanate.
[0097] this configuration -- setting -- two electrodes (21 22) if RF alternating voltage or a RF pulse voltage is impressed in between -- the catalyst particle (23) of a ferroelectric -- minding -- the counterelectrode (22) from a discharge electrode (21) -- going -- partial discharge -- being generated -- that discharging space (D) **** -- various active species are generated. The generated active species reacts with the injurious ingredient of processed air etc. in the condition that activity is high, and decomposes these components into the bottom of existence of the above-mentioned catalyst matter which a catalyst particle (23) has.
[0098] Also in this example, since he is trying to use the same catalyst matter as ****, processed air (or processed gas) can be processed using effectively the active species generated by the low-temperature plasma, and the chemical reaction in that case can be promoted by leaps and bounds. since [therefore,] the throughput of a plasma catalytic-reaction machine (20) can be heightened -- air cleaner (1) etc. -- the capacity in the case of applying a reactor (20) can also be heightened sharply.
[0099] (Modification 5) In a plasma catalytic-reaction machine (20), glow discharge is used for the modification 5 of the operation gestalt 3 as a discharge method. In this example, it is based on drawing 11 , and is a discharge means (21 22). Only a configuration is explained.
[0100] In this example, the cylindrical electrode is used as a discharge electrode (21), and the flat electrode with openings, such as mesh material and a punching metal, is used for the counterelectrode (22). and two electrodes (21 22) **** -- the high voltage power supply (not shown) is connected and he is trying for glow discharge to arise at the edge of the counterelectrode (22) approach in a discharge electrode (21) In this case, it is discharging space (D) to the point

by the side of the counterelectrode (22) in a discharge electrode (21). It is formed.
[0101] thus, two electrodes (21 22) even if it constitutes so that glow discharge may be caused -- discharging space (D) **** -- active species is generated. Radicals, such as a high-speed electron which promotes the processing reaction of the processed fluid in a plasma catalytic-reaction machine (20), ion, ozone, and a hydroxy radical, and other excited molecules (an excitation oxygen molecule, an excitation nitrogen content child, excitation water molecule, etc.) are contained in this active species like each above-mentioned discharge method.
[0102] Processing members (23) are two electrodes (21 22) like each above-mentioned example. It is arranged near the counterelectrode (22) in between, and the same thing as the operation gestalt 1 is used also for the catalyst. For this reason, since the various active species generated by the low-temperature plasma are used effective in the processing at the time of performing air cleaning, the chemical reaction at the time of processing processed air can be promoted by leaps and bounds. since [therefore,] the throughput of a plasma catalytic-reaction machine (20) can be heightened -- air cleaner (1) etc. -- capacity can also be heightened.
[0103]
[Example] Next, in a plasma catalytic-reaction machine (20), the example using the catalyst by which it is characterized [of this invention], and the examples 1 and 2 of a comparison using the conventional catalyst are explained, carrying out comparison contrast of the processing engine performance of a processed fluid.
[0104] first, the catalyst which turns into a catalyst of an example from manganese, iron, and a cerium as the operation gestalt 1 explained -- a coprecipitation method -- preparing -- this -- honeycomb-like base material (23a) from -- it was used for the constituted processing member (23). The presentation ratios of the manganese in the catalyst of this example, iron, and a cerium were 30%, 60%, and 10%, respectively.
[0105] Moreover, the commercial manganese oxide system catalyst was used for the catalyst of the example 1 of a comparison as a catalyst conventionally used combining the low-temperature plasma. The presentation ratios of manganese and aluminum of this catalyst were 60% and 40% including manganese and aluminum, respectively.
[0106] Moreover, the commercial platinum system catalyst was used for the catalyst of the example 2 of a comparison as a catalyst conventionally used combining the low-temperature plasma. The presentation ratios of platinum and aluminum of this catalyst were 0.5% and 99.5% including platinum and aluminum, respectively.
[0107] Next, the experiment conducted using the catalyst of the above-mentioned example and the examples 1 and 2 of a comparison is explained. First, the experimental device constituted as the reaction section showed drawing 12 was used for the experiment. This experimental device is constituted so that streamer discharge may be generated. Setting to this equipment, a discharge electrode (21) is a needle electrode (21a) of brass with a diameter [of 2mm], and a die length of 8mm. Three are horizontally arranged at intervals of 17.5mm, and it is each needle electrode (21a). It considered as the configuration which has arranged the train to two steps perpendicularly at intervals of 20mm. Moreover, 61x80mm stainless steel mesh material was used for the counterelectrode (22). And the gap of a discharge electrode (21) and a counterelectrode (22) is set to 22mm, and it is a needle electrode (21a). It has arranged so that the counterelectrode (22) of stainless steel mesh material may become a right angle, and it considered as the configuration which impresses the direct-current high voltage (20Kv).
[0108] Moreover, it arranges so that what supported each catalyst of the above-mentioned example and the examples 1 and 2 of a comparison to the processing member (23) of the shape of a honeycomb whose thickness is 10mm may be stuck to a counterelectrode (22) between a discharge electrode (21) and a counterelectrode (22), and it is a needle electrode (21a). The gap of a tip and a processing member (23) was set as 12mm. Needle electrode (21a) The tip should delete the point by the 60-degree cutting angle (theta), as shown in drawing 13 , and a tip shall have few [a radius R] radii of circle as a spherical-surface configuration which is 0.5mm.
[0109] Thus, needle electrode (21a) If whenever [point-angle] (theta) is set as about 60 degrees, as explained in the above-mentioned operation gestalt 1, streamer discharge will occur in the large range which spreads in the shape of the flare toward a counterelectrode (22) from a discharge electrode (21).
[0110] In the above equipment configuration, the processed fluid containing toluene 100ppm is introduced into an experimental device with three kinds of space velocity (1000h-1, 2000h-1, 5000h-1), the magnitude of attenuation of the reactant when impressing the electrical potential difference of 20Kv and the augend of a product are measured, respectively, and the measurement result of having investigated the oxidative degradation property (processing property) over the odor component of each catalyst is shown in the graph of drawing 14 .
[0111] According to drawing 14 , since decomposition effectiveness is high as compared with the comparison catalysts 1 and 2 which are catalysts conventionally, the catalyst of this example is understood that the activity is very high. When space velocity is 1000h-1, an invention catalyst is transient, has 70% or more of oxidative degradation engine performance, and specifically, it has the catalyst about 1.5 times of a commercial platinum system catalyst, and twice

[about] the engine performance of a commercial manganese system.
[0112] It turns out that the processing engine performance will be sharply raised from the above thing by promoting the chemical reaction at the time of processing a processed fluid in a plasma catalytic-reaction machine (20) if the catalyst of this example is used.
[0113]
[The gestalt of operation of others of invention] This invention is good also as following configurations about the above-mentioned operation gestalt.
[0114] For example, discharging space formed between a discharge electrode (21) and a counterelectrode (22) in a processing member (23) in the modification 1 (drawing 6) of the operation gestalt 1 (drawing 1 - drawing 3), the operation gestalt 2 (drawing 4), the operation gestalt 3 (drawing 5), and the operation gestalt 3 (D) Although arranged near the counterelectrode (22) in inside Like the modification 2 (drawing 8) of the operation gestalt 3, this modification 3 (drawing 9), this modification 5 (drawing 11), etc., a processing member (23) is discharging space (D), as shown in drawing 15 . You may arrange to the downstream.
[0115] Moreover, in the partial discharge method of drawing 10 , instead of being filled up with a catalyst particle into a tubed counterelectrode (22), as shown in drawing 16 , you may equip with the honeycomb-like processing member (23) of the shape of a cylindrical shape which has the catalyst matter of this invention in this counterelectrode (22). In this case, compared with the example of drawing 10 , a draft resistance becomes small and can increase the amount of raw gas.
[0116] moreover, it is shown in drawing 17 -- as -- a line -- you may arrange so that a catalyst particle or a honeycomb processing member (23), a cylindrical glass tube (insulating tube) (27), and a tubed electrode (counterelectrode) (22) may be piled up sequentially from the inside centering on an electrode (discharge electrode) (21). In this case, a ferroelectric is used for the base material of a processing member (23). Thus, if the electron emitted from the discharge electrode (21) when constituted moves to the direction outside of a path through a honeycomb-like processing member (23) and a charge collects on the inside of a glass tube (27), since this charge will carry out the operation which makes the potential difference small, the discharge stabilized without resulting in a spark can be generated.
[0117] And also in these drawing 16 and drawing 17 , since the chemical reaction of a processed fluid can be promoted using effectively the active species generated by the low-temperature plasma by using the catalyst by which it is characterized [of the invention in this application] like the above, it becomes possible [raising the processing engine performance of a reactor (20)].
[0118] In addition, in the example of drawing 16 and drawing 17 , a pulse power source may be used and AC power supply may be used.
[0119] It is discharging space (D) about these processing members as a configuration which, on the other hand, divided the 1st processing member which constitutes a catalyst means, and the 2nd processing member which constitutes an adsorption means although the processing member (23) consisted of above-mentioned operation gestalten as what has the function of both a catalyst means and an adsorption means. You may arrange separately to inside or its downstream.

[0120] moreover -- each above-mentioned operation gestalt -- a plasma catalytic-reaction machine (20) -- air cleaner (1) Nitrogen-oxides purge (2) And combustion emission-gas-purification equipment (3) etc. -- although the applied example was explained, this plasma catalytic-reaction machine (20) can be applied to other equipments which process processed fluids, such as a conditioner and a bio-type waste disposer
[0121] Furthermore, in the above-mentioned example, as a catalyst, although it is made to carry out, the catalyst using what was constituted with manganese, iron, and a cerium used by this invention should just contain the mixture or the multiple oxide of a manganic acid ghost, and iron, a cerium, europium, a lanthanum and at least one sort of oxides of the copper.
[0122] Moreover, irrespective of the tip configuration of a needle electrode, although the high voltage of a direct current is impressed in the electrode configuration which specified the tip configuration of a needle electrode (21) and he is trying to generate streamer discharge in a large field in the above-mentioned operation gestalt, if the high-voltage power source of a pulse is used, it will become possible to generate streamer discharge in a large field.
[0123] If the build up time of a pulse is as short as 100 or less ns extent and pulse width specifically impresses the steep pulse height electrical potential difference which is extent between two electrodes 1 or less microsecond, streamer discharge can be caused in the comparatively large range which spread in the shape of the flare toward the counterelectrode side. thus, as a reason streamer discharge will be generated in a large field if pulse shape is specified ** Since the impression time amount of an electrical potential difference is short, a high electrical potential difference which is kept very much in a spark in the usual discharge can be impressed momentarily, ** Since there being little

control of discharge by the space charge effect since discharge becoming easy to break out in all locations and ** electrical-potential-difference standup are steep when applied voltage's is made high, and ** build up time are short, it can mention that uniform discharge tends to break out etc.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the presentation of the catalyst especially used for a plasma catalytic-reaction machine about the air cleaner using the plasma catalytic-reaction machine which promotes the chemical reaction of a processed fluid combining the low-temperature plasma and catalyst which are generated by discharge, and this plasma catalytic-reaction machine, a nitrogen-oxides purge, combustion emission-gas-purification equipment, a dioxin cracking unit, and a chlorofluocarbon cracking unit.

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PRIOR ART

[Description of the Prior Art] Conventionally it faces processing processed fluids, such as air cleaning, and various catalysts are used in order to promote a chemical reaction. As processing using a catalyst, there is the heat catalyst method for activating a catalyst with heating first. Generally he uses noble-metals system catalysts, such as platinum, and is trying to promote oxidation reaction of the processed component in air in this approach. Although the capacity which promotes a chemical reaction rather than the approach of using a following photocatalyst and ozone gas is excellent, since this approach has the need (however, this temperature changes with reactants to oxidize) of generally heating and using a catalyst for an elevated temperature 300 degrees C or more, it has a fault with a comparatively high running cost.

[0003] Next, the photocatalyst method which promotes a chemical reaction using a photocatalyst is also learned. since this approach is the reaction of ordinary temperature, although it is easy to carry it in an air cleaner, since its life of an ultraviolet ray lamp required in order to fully activate a photocatalyst is short -- this ultraviolet ray lamp -- being periodical (every [for example,] several months) -- if it does not exchange, operation cannot be continued over a long period of time, but a great effort and costs are required with that exchange. Furthermore, a photocatalyst method also has the fault which is inferior in the capacity to advance a chemical reaction generally compared with a heat catalyst method.

[0004] Moreover, as an approach of promoting a chemical reaction, the ozone method for using the ozone gas other than the above is also learned. This approach is the reaction of ordinary temperature, and the equipment which decomposes residual ozone gas into oxygen for the harmful nature of ozone gas in addition to the equipment made to generate ozone gas being required is also required. For this reason, in the case of the ozone method, the equipment configuration tends to become complicated and sufficient safety practice is also required. Moreover, there is a fault to which this ozone method is also inferior in the capacity to promote a chemical reaction too compared with a heat catalyst method.

[0005] On the other hand, as other approaches of promoting a chemical reaction, there is the plasma catalyst method for processing combining the plasma and catalyst which were generated by discharge. He activates a catalyst conventionally using the heat at the time of discharge generating the plasma, light, ozone, etc., and is trying to promote a chemical reaction by this approach. And since a high-speed electron and low-speed ion are generated, ion is a low speed and the thermodynamic temperature of reaction space hardly rises to the energy of a high-speed electron being 10eV or more (it being 100,000 degrees C or more by temperature conversion) when using especially the low-temperature plasma, a running cost can be held down compared with a heat catalyst method. Moreover, since this approach is sharply raised in the activity of a catalyst compared with a photocatalyst method or the ozone method, its capacity to promote a chemical reaction is also high.

[0006] As this plasma catalyst method, no-odor-izing or the technique which defangs and purifies air is indicated by JP,8-266854,A in the odor component or the injurious ingredient. He is trying to use the ozone generated in case discharge generates the plasma, heat, and light with a technique given in this official report using the manganese system catalyst which has the property which decomposes ozone into oxygen and active oxygen, the platinum catalyst activated with heat, the titanium oxide catalyst activated by light.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to the solution means of the above 1st, by having specified the catalyst matter, in case the various active species generated by the low-temperature plasma process processed fluids, such as air cleaning, it is used effectively, and the chemical reaction in that case can be promoted by leaps and bounds. Therefore, the throughput of a plasma catalytic-reaction machine (20) can be heightened now. Moreover, since a throughput is heightened in this way, it also becomes possible to miniaturize a reactor (20).
[0032] According to the solution means of the above 2nd, among the catalyst matter, since he is trying for a catalyst to adsorb more active species by setting up the presentation ratio of Mn oxide to 20% - 50%, and enlarging specific surface area of a catalyst, the chemical reaction at the time of processing a processed fluid can be promoted further. Therefore, it becomes possible to heighten the throughput of a plasma catalytic-reaction machine (20) more.
[0033] Moreover, since it enables it to use many kinds of active species by the time of processing of a processed fluid by including Mn oxide with which the oxidation number is different in a catalyst according to the solution means of the above 3rd, it becomes possible to promote a reaction further. Therefore, the throughput of a plasma catalytic-reaction machine (20) can be heightened further.
[0034] Moreover, a discharge means to cause streamer discharge, pulse corona discharge, corona discharge, creeping discharge, silent discharge, partial discharge, or glow discharge according to the solution means of the above 4th (21 22) It uses and the low-temperature plasma is generated, and since he is trying to promote the chemical reaction of a processed fluid using the various active species contained in the gas, the plasma catalytic-reaction machine (20) of various discharge methods is utilizable.
[0035] Moreover, it is discharging space (D) in a catalyst means (23) about an adsorption means (23) to adsorb the processed component of a processed fluid according to the solution means of the above 5th. Inside or discharging space (D) It arranges to the downstream. Since he is trying to adsorb the processed component which a processed fluid contains with an adsorption means (23), the processed component of which not only a processed component but an adsorption means (23) by which the active species contained in low-temperature plasma-like gas floated in a processed fluid was adsorbed also carries out decomposition processing certainly. Therefore, the processing engine performance of a plasma catalytic-reaction machine (23) can be raised more. Moreover, since the processing engine performance can be prevented from falling if a processed component is caught with an adsorption means (23) in this way and it enables it to decompose even if it shortens a charging time value, it is also possible to raise energy-saving nature.
[0036] moreover, above-mentioned the 6- by having specified the configuration of a catalyst as the above-mentioned Mn oxide and the specific oxide in various kinds of equipments which use together the low-temperature plasma and a catalyst means (23), and process a processed fluid according to the 10th solution means since the active species generated by discharge can be used effectively -- respectively -- air cleaner (1) Nitrogen-oxides purge (2) Combustion emission-gas-purification equipment (3) Dioxin cracking unit (4) And chlorofluocarbon cracking unit (5) etc. -- a throughput can be heightened.
[0037]
[The gestalt 1 of implementation of invention] Hereafter, the operation gestalt of this invention is explained to a detail based on a drawing.
[0038] This operation gestalt is an air cleaner (1) which processes the odor component or injurious ingredient in processed air by oxidative degradation, and purifies air. It is related. Drawing 1 is this air cleaner (1). The outline configuration is shown.
[0039] It is this air cleaner (1) so that it may illustrate. It is the configuration that each functional part was contained in casing (10), and the dust collection filter (11), the centrifugal fan (12), and the plasma catalytic-reaction machine (20) are contained in casing (10) as a functional part. In addition, it is the ozonolysis catalyst for decomposing the ozone

generated by discharge with a plasma reactor (20) which the sign (13) shows to drawing 1 .
[0040] In one side face (side face on the right-hand side of drawing) of casing (10), the air suction port (15) for inhaling air is formed in casing (10), and the air port (16) for blowing off purification air is formed in the top face. In an air suction port (15), it is an intake grill (15a). It is prepared and is a blow-off grill (16a) in an air port (16). It is prepared. Moreover, in an air suction port (15), it is an intake grill (15a). The above-mentioned dust collection filter (11) is arranged inside, and it is made to carry out uptake of the dust contained in intake air.
[0041] The air port (16) is formed in the edge (edge on the left-hand side of drawing 1) of the opposite side with the air suction port (15) on the top face of casing (10). And corresponding to this air port (16), the above-mentioned centrifugal fan (12) is prepared in casing (10). In this centrifugal fan (12), it is a power source for fans (12a). It connects. In the above configuration, as for the interior of casing (10), between an air suction port (15) and air ports (16) is the circulation space of processed air. And if a centrifugal fan (12) is started, processed air is the intake grill (15a) of an air suction port (15). And it absorbs in casing (10) through a dust collection filter (11). after processing with the reactor (20) which explains processed air in full detail below -- blow-off grill (16a) of an air port (16) from -- it blows off besides casing (10).
[0042] The sectional view in which drawing 2 shows the outline configuration of a plasma reactor (20), and drawing 3 are perspective views. This plasma reactor (20) is the discharge electrode (21) as a discharge means for generating the low-temperature plasma and counterelectrodes (22), and these electrodes (21 22). It has the processing member (23) arranged by approaching a counterelectrode (22) in between. That is, a processing member (23) is discharging space (D). It is arranged in inside.
[0043] stoma (23b) of a large number which penetrate this processing member (23) along the flow direction of air Base material (23a) of the honeycomb configuration which it has from -- it is constituted and the catalyst matter is supported on that front face. Concretely, this processing member (23) contains the mixture or the multiple oxide of a manganic acid ghost, and iron, a cerium, europium, a lanthanum and at least one sort of oxide in copper (henceforth a specific oxide) as catalyst matter. And the presentation ratio of Mn oxide in the catalyst matter is 20% - 50%, and the processing member (23) is set up so that the presentation ratio of a specific oxide may become 80% - the 50 remaining%. Moreover, two or more kinds of manganic acid ghosts from which the oxidation number is different, such as MnO2 and Mn 2O3, are contained in the catalyst matter.
[0044] The catalyst of this operation gestalt consists of manganese, iron, and a cerium, is the following, and was specifically made and prepared. That is, the water solution of manganese nitrate 6 hydrate was first prepared as a manganese compound, cerium-nitrate 6 hydrate as a cerium compound was added to this, iron nitrate 9 hydrate was further added as an iron compound, and it considered as A liquid. On the other hand, B liquid with which water comes to melt an alkali compound was produced as a precipitate reagent. And the coprecipitate was made to generate by slushing A liquid, agitating B liquid. Then, aging of 1 hour is performed, the above-mentioned coprecipitate was washed and dried, by calcinating for 5 hours at the temperature of 500 degrees C in air, the catalyst which consists of manganese, iron, and a cerium was acquired, and this was used for the honeycomb-like processing member (23).
[0045] The above-mentioned processing member (23) is a base material (23a). On the front face, the adsorbent is also supported with the above-mentioned catalyst matter. An adsorbent adsorbs processed components contained in processed air, such as odorant and harmful matter, and activated carbon, a zeolite, etc. are used. In addition, it is good for an adsorbent to use porous ceramics, activated carbon fiber, mordenite, a ferrierite, Silicalite, etc., and to use at least one of sorts of these.
[0046] As mentioned above, since the processing member (23) has the catalyst matter and an adsorbent, it is also an adsorption means to adsorb the processed component contained to processed air, in this operation gestalt while this processing member (23) is a catalyst means to promote the processing at the time of purifying processed air.
[0047] the above-mentioned discharge electrode (21) -- electrode plate (21b) This electrode plate (21b) Two or more needle electrodes (21a) fixed so that it might intersect perpendicularly mostly from -- it is constituted. Electrode plate (21b) Opening of a large number which consist of mesh material, a punching metal, etc. and air passes in the direction of a field right angle (21c) It has. Moreover, opening of a large number which air passes in the direction of a field right angle like mesh material or a punching metal to a counterelectrode (22) (22a) The electrode plate which it has is used. And a discharge electrode (21) is an electrode plate (21b). It is almost parallel to a counterelectrode (22), and is a needle electrode (21a). It is arranged so that it may become a right angle to a counterelectrode (22) mostly.
[0048] two electrodes (21 22) **** -- high voltage power supply of a direct current

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, by the plasma catalyst method of the above-mentioned official report, in case only the ozone at the time of generating the plasma, heat, and light are used but discharge generates the plasma, the various active species (for example, a hydroxy radical, an excitation oxygen molecule, an excitation nitrogen content child, an excitation water molecule, etc.) generated with ozone, heat, and light are not used. If these active species are used effectively, it will be thought that the reaction of a processed fluid can be promoted, but since these active species are not used at all by the conventional describing [above] plasma catalyst method, the reactivity of a processed fluid cannot fully be raised.
[0008] The place which this invention is originated in view of such a trouble, and is made into the purpose is raising labile more and heightening the throughput of a reactor in the plasma catalytic-reaction machine which promotes a chemical reaction combining the low-temperature plasma and a catalyst.

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MEANS

[Means for Solving the Problem] This invention enables it to promote the reaction in the cases, such as gassing, by specifying the component of the catalyst used for a plasma catalytic-reaction machine (20), and using the various active species generated by the plasma effective in processing of a processed fluid.
[0010] Concretely, the 1st solution means which this invention devised is a discharge means (21 22) to generate the low-temperature plasma by discharge in the circulation space of a processed fluid. This discharge means (21 22) Discharging space which can be set (D) Inside or discharging space (D) It is premised on the plasma catalytic-reaction machine (20) equipped with the catalyst means (23) arranged at the downstream. And this plasma catalytic-reaction machine (20) is characterized by the above-mentioned catalyst means (23) containing the mixture or the multiple oxide of a manganic acid ghost (henceforth Mn oxide), and iron, a cerium, europium, a lanthanum and at least one sort of oxide in copper (henceforth a specific oxide) as catalyst matter.
[0011] It sets for this 1st solution means, and is a discharge means (21 22). A processed fluid's passage of the discharging space (D) formed generates the low-temperature plasma. Various active species are generated by this low-temperature plasma, and radicals which are ozone etc., such as others and a hydroxy radical, an excitation oxygen molecule, an excitation nitrogen content child, an excitation water molecule, etc. are contained in these active species. And these active species of various kinds of react efficiently with an injurious ingredient and an odor component with a high active state according to an operation of a catalyst, and carry out decomposition removal of these matter.
[0012] More specifically, Mn oxide contained in the catalyst decomposes into oxygen and active oxygen the ozone generated by discharge. This active oxygen oxidizes and decomposes the injurious ingredient and odor component of a processed fluid into a harmless component or a no odor component. Moreover, various active species including the active oxygen obtained by decomposition of ozone, such as radicals, such as a hydroxy radical contained in low-temperature plasma-like gas, and an excitation oxygen molecule (active oxygen), an excitation nitrogen content child, an excitation water molecule, are adsorbed by the front face of the above-mentioned specific oxide and the interface of Mn oxide and specific oxide which are included in a catalyst means (23) with a radical or an excitation state. For this reason, on the surface of [case / where the injurious ingredient and odor component in a processed fluid use the conventional catalyst] a catalyst, active species with high activity will exist mostly as an active group, and it is decomposed into a high speed.
[0013] Moreover, the 2nd solution means which this invention devised is characterized by a catalyst means (23) making the presentation ratio of the manganic acid ghost in the catalyst matter 20% - 50% in the plasma catalytic-reaction machine (20) concerning the solution means of the above 1st. In this case, since the above-mentioned specific oxide occupies the remainder of Mn oxide in the catalyst matter, that presentation ratio becomes 80% - 50%.
[0014] In this 2nd solution means, among the catalyst matter, since the presentation ratio of Mn oxide is set up to 20% - 50%, Mn oxide and a specific oxide distribute, it is made detailed and the specific surface area of a catalyst increases. Consequently, since the interface of Mn oxide and a specific oxide increases, a catalyst adsorbs more active species and activity improves further.
[0015] Moreover, for the 3rd solution means which this invention devised, it sets in the plasma catalytic-reaction vessel (20) concerning the above 1st or the 2nd solution means, and a catalyst means (23) is MnO2 as catalyst matter. It is characterized by including two or more kinds of manganic acid ghosts from which the oxidation numbers, such as Mn 2O3, differ.
[0016] In this 3rd solution means, since he is trying for a catalyst to contain Mn oxide with which the oxidation number is different, as compared with the case where the number of Mn oxides is one, various active species will be further adsorbed in the case of the processing reaction of a processed fluid, and a reaction can be presented.
[0017] Moreover, it sets in the plasma catalytic-reaction vessel (20) concerning the above 1st, 2nd, or 3rd solution

means, and the 4th solution means which this invention devised is a discharge means (21 22). It is characterized by being constituted by streamer discharge, pulse corona discharge, corona discharge, creeping discharge, silent discharge, partial discharge, or glow discharge so that the low-temperature plasma may be generated. According to a discharge method, various kinds of high voltage power supplies, such as a direct current, an alternating current, and a pulse, can be used for the power source for causing these discharge.

[0018] It sets for this 4th solution means, and is a discharge means (21 22). The low-temperature plasma is generated because set and various kinds of discharge takes place, and it is used for the various active species contained in that gas promoting the chemical reaction of a processed fluid under existence of the above-mentioned catalyst.

[0019] Moreover, the 5th solution means which this invention devised is set in the plasma catalytic-reaction vessel (20) concerning the above 1st, 2nd, 3rd, or 4th solution means. Discharge means (21 22) Discharging space (D) Inside or discharging space (D) It is characterized by arranging an adsorption means (23) to adsorb the processed component contained in a processed fluid at the downstream, with the catalyst means (23).

[0020] In this 5th solution means, since an adsorption means (23) is adsorbed in the processed component which a processed fluid contains, with the processed component which is contained in a processed fluid and is floating under existence of a catalyst, the active species contained in low-temperature plasma-like gas acts also on the processed component of which the adsorption means (23) is adsorbed, and carries out decomposition removal of these components. That is, discharging space (D) The various active species generated act not only on the processed component which floats in a processed fluid but on the processed component of which the adsorption means (23) was adsorbed.

[0021] Moreover, the 6th solution means which this invention devised is an air cleaner (a deordorization machine and air cleaner) (1) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. It is related. This air cleaner (1) This plasma catalytic reaction machine (20) be equip with casing (10) contain inside, processed air be introduce in this casing (10), and it be a discharge means (21 22). Discharge space (D) And by pass a catalyst means (23), it be characterize by be constitute so that the odor component or injurious ingredient in this processed air may be process.

[0022] With this 6th solution means, processed air is purified in the odor component or injurious ingredient in processed air by processing oxidative degradation etc. with the low-temperature plasma and a catalyst means (23).

[0023] Moreover, the 7th solution means which this invention devised is related with the nitrogen-oxides purge (2) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. This nitrogen-oxides purge (2) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, processed gas is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And by passing a catalyst means (23), it is characterized by being constituted so that the nitrogen oxides in this processed gas may be processed.

[0024] With this 7th solution means, processed gas is purified in the nitrogen oxides in non-raw gas by processing reduction decomposition etc. with the low-temperature plasma and a catalyst means (23).

[0025] Moreover, the 8th solution means which this invention devised is related with the combustion emission-gas-purification equipment (3) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. This combustion emission-gas-purification equipment (3) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside. A combustion gas is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And while processing the nitrogen oxides in this combustion gas by passing a catalyst means (23) It is characterized by being constituted so that an unburnt fuel and a hydrocarbon may be processed.

[0026] A combustion gas is purified by this 8th solution means by processing an unburnt fuel and a hydrocarbon by oxidative degradation etc., while using together the low-temperature plasma and a catalyst means (23) and processing the nitrogen oxides in a combustion gas by reduction decomposition etc.

[0027] Moreover, the 9th solution means which this invention devised is a dioxin cracking unit (4) using the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. It is related. This dioxin cracking unit (4) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, a combustion gas is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And by passing a catalyst means (23), it is characterized by being constituted so that the dioxin in this combustion gas may be processed.

[0028] With this 9th solution means, a combustion gas is purified in the dioxin in a combustion gas by processing oxidative degradation etc. with the low-temperature plasma and a catalyst means (23).

[0029] Moreover, the 10th solution means which this invention devised is a chlorofluocarbon cracking unit (5) using

the plasma catalytic-reaction machine (20) concerning the above 1st, 2nd, 3rd, 4th, or 5th solution means. It is related. This chlorofluocarbon cracking unit (5) This plasma catalytic-reaction machine (20) is equipped with casing (10) contained inside, chlorofluocarbon is introduced in this casing (10), and it is a discharge means (21 22). Discharging space (D) And by passing a catalyst means (23), it is characterized by being constituted so that this chlorofluocarbon may be disassembled.

[0030] With this 10th solution means, decomposition processing of the chlorofluocarbon can be certainly carried out by using together the low-temperature plasma and a catalyst means (23).

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EXAMPLE

[Example] Next, in a plasma catalytic-reaction machine (20), the example using the catalyst by which it is characterized [of this invention], and the examples 1 and 2 of a comparison using the conventional catalyst are explained, carrying out comparison contrast of the processing engine performance of a processed fluid.
[0104] first, the catalyst which turns into a catalyst of an example from manganese, iron, and a cerium as the operation gestalt 1 explained -- a coprecipitation method -- preparing -- this -- honeycomb-like base material (23a) from -- it was used for the constituted processing member (23). The presentation ratios of the manganese in the catalyst of this example, iron, and a cerium were 30%, 60%, and 10%, respectively.
[0105] Moreover, the commercial manganese oxide system catalyst was used for the catalyst of the example 1 of a comparison as a catalyst conventionally used combining the low-temperature plasma. The presentation ratios of manganese and aluminum of this catalyst were 60% and 40% including manganese and aluminum, respectively.
[0106] Moreover, the commercial platinum system catalyst was used for the catalyst of the example 2 of a comparison as a catalyst conventionally used combining the low-temperature plasma. The presentation ratios of platinum and aluminum of this catalyst were 0.5% and 99.5% including platinum and aluminum, respectively.
[0107] Next, the experiment conducted using the catalyst of the above-mentioned example and the examples 1 and 2 of a comparison is explained. First, the experimental device constituted as the reaction section showed drawing 12 was used for the experiment. This experimental device is constituted so that streamer discharge may be generated. Setting to this equipment, a discharge electrode (21) is a needle electrode (21a) of brass with a diameter [of 2mm], and a die length of 8mm. Three are horizontally arranged at intervals of 17.5mm, and it is each needle electrode (21a). It considered as the configuration which has arranged the train to two steps perpendicularly at intervals of 20mm. Moreover, 61x80mm stainless steel mesh material was used for the counterelectrode (22). And the gap of a discharge electrode (21) and a counterelectrode (22) is set to 22mm, and it is a needle electrode (21a). It has arranged so that the counterelectrode (22) of stainless steel mesh material may become a right angle, and it considered as the configuration which impresses the direct-current high voltage (20Kv).
[0108] Moreover, it arranges so that what supported each catalyst of the above-mentioned example and the examples 1 and 2 of a comparison to the processing member (23) of the shape of a honeycomb whose thickness is 10mm may be stuck to a counterelectrode (22) between a discharge electrode (21) and a counterelectrode (22), and it is a needle electrode (21a). The gap of a tip and a processing member (23) was set as 12mm. Needle electrode (21a) The tip should delete the point by the 60-degree cutting angle (theta), as shown in drawing 13 , and a tip shall have few [a radius R] radii of circle as a spherical-surface configuration which is 0.5mm.
[0109] Thus, needle electrode (21a) If whenever [point-angle] (theta) is set as about 60 degrees, as explained in the above-mentioned operation gestalt 1, streamer discharge will occur in the large range which spreads in the shape of the flare toward a counterelectrode (22) from a discharge electrode (21).
[0110] In the above equipment configuration, the processed fluid containing toluene 100ppm is introduced into an experimental device with three kinds of space velocity (1000h-1, 2000h-1, 5000h-1), the magnitude of attenuation of the reactant when impressing the electrical potential difference of 20Kv and the augend of a product are measured, respectively, and the measurement result of having investigated the oxidative degradation property (processing property) over the odor component of each catalyst is shown in the graph of drawing 14 .
[0111] According to drawing 14 , since decomposition effectiveness is high as compared with the comparison catalysts 1 and 2 which are catalysts conventionally, the catalyst of this example is understood that the activity is very high. When space velocity is 1000h-1, an invention catalyst is transient, has 70% or more of oxidative degradation engine performance, and specifically, it has the catalyst about 1.5 times of a commercial platinum system catalyst, and twice [about] the engine performance of a commercial manganese system.

[0112] It turns out that the processing engine performance will be sharply raised from the above thing by promoting the chemical reaction at the time of processing a processed fluid in a plasma catalytic-reaction machine (20) if the catalyst of this example is used.
[0113]
[The gestalt of operation of others of invention] This invention is good also as following configurations about the above-mentioned operation gestalt.
[0114] For example, discharging space formed between a discharge electrode (21) and a counterelectrode (22) in a processing member (23) in the modification 1 (drawing 6) of the operation gestalt 1 (drawing 1 - drawing 3), the operation gestalt 2 (drawing 4), the operation gestalt 3 (drawing 5), and the operation gestalt 3 (D) Although arranged near the counterelectrode (22) in inside Like the modification 2 (drawing 8) of the operation gestalt 3, this modification 3 (drawing 9), this modification 5 (drawing 11), etc., a processing member (23) is discharging space (D), as shown in drawing 15 . You may arrange to the downstream.
[0115] Moreover, in the partial discharge method of drawing 10 , instead of being filled up with a catalyst particle into a tubed counterelectrode (22), as shown in drawing 16 , you may equip with the honeycomb-like processing member (23) of the shape of a cylindrical shape which has the catalyst matter of this invention in this counterelectrode (22). In this case, compared with the example of drawing 10 , a draft resistance becomes small and can increase the amount of raw gas.
[0116] moreover, it is shown in drawing 17 -- as -- a line -- you may arrange so that a catalyst particle or a honeycomb processing member (23), a cylindrical glass tube (insulating tube) (27), and a tubed electrode (counterelectrode) (22) may be piled up sequentially from the inside centering on an electrode (discharge electrode) (21). In this case, a ferroelectric is used for the base material of a processing member (23). Thus, if the electron emitted from the discharge electrode (21) when constituted moves to the direction outside of a path through a honeycomb-like processing member (23) and a charge collects on the inside of a glass tube (27), since this charge will carry out the operation which makes the potential difference small, the discharge stabilized without resulting in a spark can be generated.
[0117] And also in these drawing 16 and drawing 17 , since the chemical reaction of a processed fluid can be promoted using effectively the active species generated by the low-temperature plasma by using the catalyst by which it is characterized [of the invention in this application] like the above, it becomes possible [raising the processing engine performance of a reactor (20)].
[0118] In addition, in the example of drawing 16 and drawing 17 , a pulse power source may be used and AC power supply may be used.
[0119] It is discharging space (D) about these processing members as a configuration which, on the other hand, divided the 1st processing member which constitutes a catalyst means, and the 2nd processing member which constitutes an adsorption means although the processing member (23) consisted of above-mentioned operation gestalten as what has the function of both a catalyst means and an adsorption means. You may arrange separately to inside or its downstream.

[0120] moreover -- each above-mentioned operation gestalt -- a plasma catalytic-reaction machine (20) -- air cleaner (1) Nitrogen-oxides purge (2) And combustion emission-gas-purification equipment (3) etc. -- although the applied example was explained, this plasma catalytic-reaction machine (20) can be applied to other equipments which process processed fluids, such as a conditioner and a bio-type waste disposer
[0121] Furthermore, in the above-mentioned example, as a catalyst, although it is made to carry out, the catalyst using what was constituted with manganese, iron, and a cerium used by this invention should just contain the mixture or the multiple oxide of a manganic acid ghost, and iron, a cerium, europium, a lanthanum and at least one sort of oxides of the copper.
[0122] Moreover, irrespective of the tip configuration of a needle electrode, although the high voltage of a direct current is impressed in the electrode configuration which specified the tip configuration of a needle electrode (21) and he is trying to generate streamer discharge in a large field in the above-mentioned operation gestalt, if the high-voltage power source of a pulse is used, it will become possible to generate streamer discharge in a large field.
[0123] If the build up time of a pulse is as short as 100 or less ns extent and pulse width specifically impresses the steep pulse height electrical potential difference which is extent between two electrodes 1 or less microsecond, streamer discharge can be caused in the comparatively large range which spread in the shape of the flare toward the counterelectrode side. thus, as a reason streamer discharge will be generated in a large field if pulse shape is specified ** Since the impression time amount of an electrical potential difference is short, a high electrical potential difference which is kept very much in a spark in the usual discharge can be impressed momentarily, ** Since there being little control of discharge by the space charge effect since discharge becoming easy to break out in all locations and **

electrical-potential-difference standup are steep when applied voltage's is made high, and ** build up time are short, it can mention that uniform discharge tends to break out etc.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

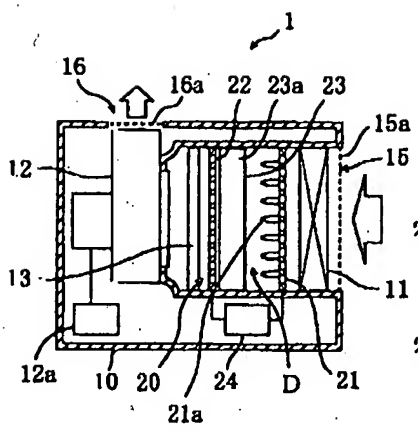
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is structural drawing of the air cleaner equipped with the plasma catalytic-reaction machine concerning the operation gestalt 1 of this invention.
[Drawing 2] It is the sectional view showing typically the configuration and discharge method (streamer discharge) of a plasma catalytic-reaction machine in the air cleaner of drawing 1 .
[Drawing 3] It is the perspective view showing typically the configuration of the plasma reactor in the air cleaner of drawing 1 .
[Drawing 4] It is drawing showing typically the configuration of the nitrogen-oxides purge concerning the operation gestalt 2.
[Drawing 5] It is the mimetic diagram showing the discharge method (pulse corona discharge) of the plasma catalytic-reaction machine concerning the operation gestalt 3.
[Drawing 6] It is the mimetic diagram showing the discharge method (corona discharge) of the plasma catalytic-reaction machine concerning the 1st modification of the operation gestalt 3.
[Drawing 7] It is the sectional view showing typically the configuration of the air cleaner which applied the plasma catalytic-reaction machine of drawing 6 .
[Drawing 8] It is the mimetic diagram showing the discharge method (creeping discharge) of the plasma catalytic-reaction machine concerning the 2nd modification of the operation gestalt 3.
[Drawing 9] It is the mimetic diagram showing the discharge method (silent discharge) of the plasma catalytic-reaction machine concerning the 3rd modification of the operation gestalt 3.
[Drawing 10] It is the mimetic diagram showing the discharge method (partial discharge) of the plasma catalytic-reaction machine concerning the 4th modification of the operation gestalt 3.
[Drawing 11] It is the mimetic diagram showing the discharge method (glow discharge) of the plasma catalytic-reaction machine concerning the 5th modification of the operation gestalt 3.
[Drawing 12] It is the outline block diagram of the experimental device in an example.
[Drawing 13] It is the enlarged drawing showing the tip configuration of the discharge electrode in the experimental device of drawing 3 .
[Drawing 14] It is the graph which shows the experimental result of an example.
[Drawing 15] It is drawing showing the modification which arranges a processing member to the downstream of discharging space.
[Drawing 16] It is drawing showing the modification of the partial discharge method of drawing 10 .
[Drawing 17] It is drawing showing the 2nd modification of the partial discharge method of drawing 10 .
[Description of Notations]
(1) Air cleaner
(2) Nitrogen-oxides purge
(3) Combustion emission-gas-purification equipment
(4) Dioxin cracking unit
(5) Chlorofluocarbon cracking unit
(10) Casing
(11) Dust collection filter
(12) Centrifugal fan
(15) Air suction port (gas inlet)
(16) Air port (gas exhaust)

(20) Plasma catalytic-reaction machine
(21) Discharge electrode
(22) Counterelectrode
(23) Processing member (a catalyst means, adsorption means)
(24) High voltage power supply

[Translation done.]

【図1】



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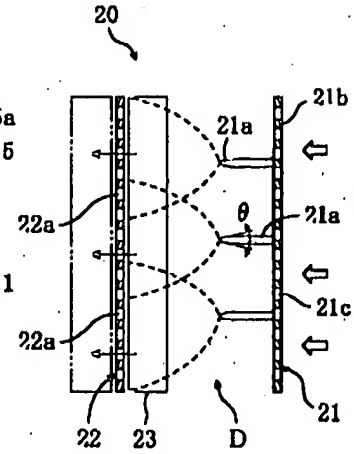

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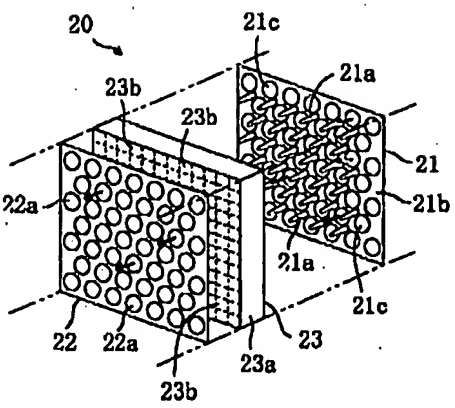

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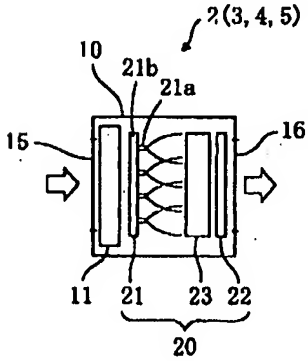

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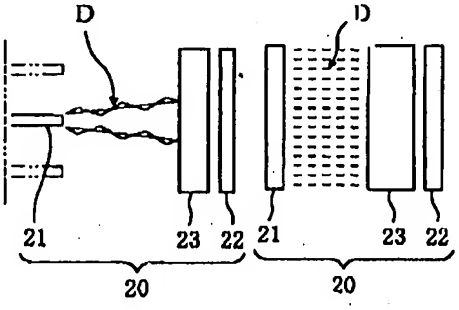

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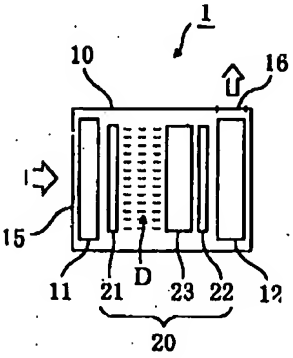

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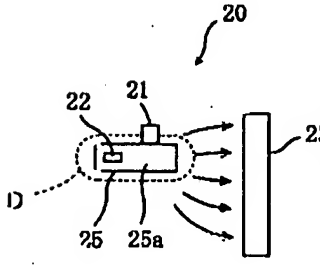
【図8】



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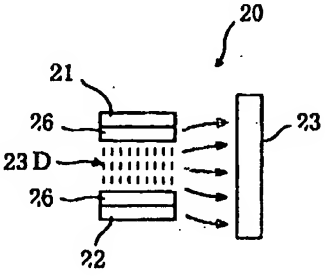

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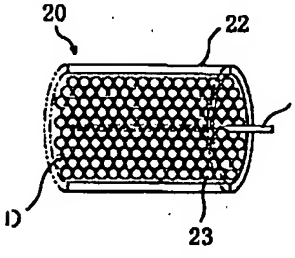

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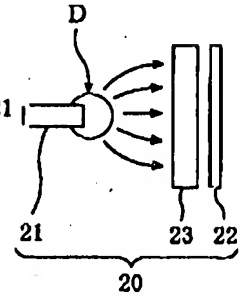

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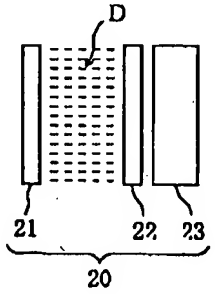

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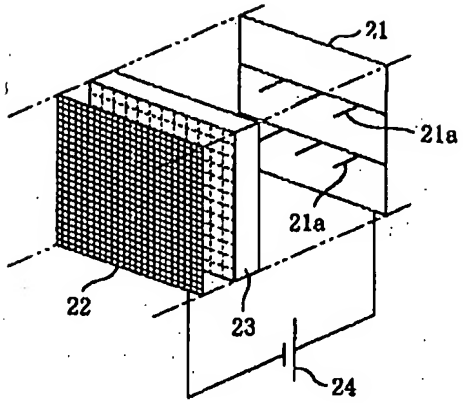

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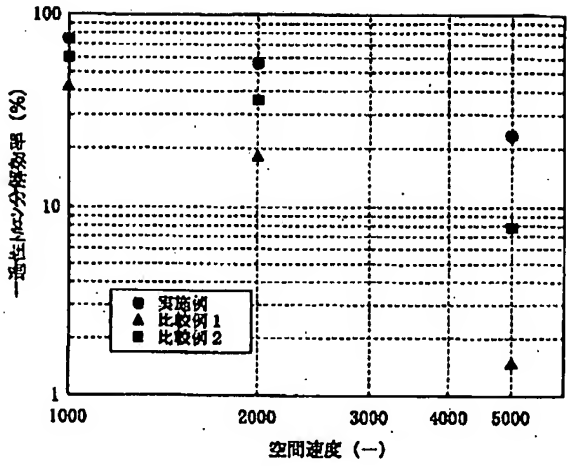

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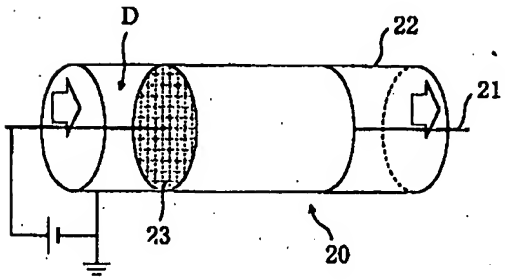

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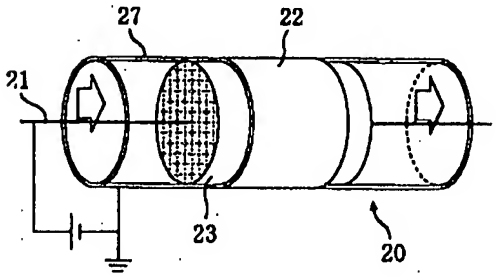

フロントページの続き

(51)Int.Cl.[7]	識別記号	FI		(参考)
C07D	319/24	B01D	53/36	B
H05H	1/48	B01J	23/84	311A

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